## REMARKS

The claims have been amended in the attached Preliminary Amendment to remove multiple dependencies and to place the application in proper U.S. format and to conform with proper grammatical and idiomatic English. None of the amendments herein are made for reasons related to patentability. No new matter has been added.

In the event the U.S. Patent and Trademark Office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing docket no. **449122080600**. However, the Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

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Respectfully submitted,

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# Echo suppression with short delay

## CLAIM FOR PRIORITY

This application is a national stage of PCT/EP03/010576, published in the German language on September 23, 2003, which claims the benefit of priority to German Application No. 0203552.9, filed on October 22, 2002.

## TECHNICAL FIELD OF THE INVENTION

The invention relates to a method and a device for reducing echoes in uplink data, and in particular to echoes in uplink data to be transmitted in a telecommunications network coming from a terminal.

## BACKGROUND OF THE INVENTION

In a very wide variety of telecommunications networks (especially cellular mobile radio networks such as GSM, UMTS, CDMA-IP-based networks etc.) an echo can occur in data sent from a terminal in the direction of the mobile radio network (uplink data), which can arise because acoustic signals output at the terminal by a loudspeaker (which are based on downlink data transmitted from the network to the terminal) are output and picked up in a more or less weak form by the microphone of the terminal. The microphone of the terminal thus receives acoustic signals from the terminal user currently speaking (or using the mobile radio terminal in some other way) and additionally a weak noise in the form of the speech component of the person with whom the terminal user is speaking reproduced

by the loudspeaker of the terminal (arriving as downlink data from the network at the terminal). The voice data of the terminal user recorded by the microphone and the additional (noise) data recorded by the microphone which a microphone in or on the terminal has picked up are transmitted jointly to the other party in the terminal user's call so that in addition to the voice signal of the terminal user, the latter hears his own voice as an echo (that is the voice sequence of the other party in the terminal user's call partner which was transmitted from them to the loudspeaker of the terminal, to the microphone and from the microphone via the terminal back to the other party).

For this echo cancellers = echo compensators) are proposed in mobile radio networks (known for example from www.etsi.org etc. or Jacek Biala „Mobilfunk and intelligente networks (mobile radio and intelligent networks)", Vieweg-Verlag, ISBN 3-528-15302-4, pages 109, 127 and 344 ). In a switching device of a mobile radio network the data arrives as a rule via ATM AAL-2 connections or other connections, with the data being encoded in a mobile radio codec format (especially AMR format) for compressed transmission especially over the air interface. For echo cancellation speech encoded in the codec format is transcoded into a format representing the speech over the course of time for example, such as TDM (Time Division Multiplex) format (that is converted as regards encoding) and the echo (of the downlink data) contained in the uplink data coming from the terminal is

reduced as far as possible by taking into account the downlink data in the uplink data (echo cancellation). By avoiding this echo the speech quality is significantly improved. However this process delays the transmission to the other party of uplink data originating from the terminal over the telecommunications network and also the transmission to the terminal of data originating from the other party as downlink data over the telecommunications network.

## SUMMARY OF THE INVENTION

The present invention discloses a reduction of the echo in the uplink data coming from a terminal, to optimize as efficiently as possible the delay in data by echo cancellation.In accordance with one embodiment of the invention, the data (downlink-data) to be sent to the terminal is copied and sent as original or as a copy to the terminal, whereas a copy or the original of the downlink data is used transcoded to reduce the echo in uplink data. On the one hand, the downlink data arrives without delay at the terminal and, on the other hand, echo cancellers can be used simply and efficiently in a manner known per se without modification to reduce the echo in uplink data.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in more detail below with reference to the exemplary embodiments on the basis of the drawings. The Figures show:

Figure 1 a schematic diagram of how echoes are known to

arise.

Figure 2 shows echo cancellation in a telecommunications network in accordance with the invention.

Figure 3 shows reduction of the echo in accordance with the invention while avoiding the delay in the transmission of downlink data.

## DETAILED DESCRIPTION OF THE INVENTION

Figure 1 shows a user 1 of a terminal (not shown) comprising a microphone 2 and a loudspeaker 3 which (2,3) is located for example in a vehicle or a room 4. The loudspeaker 3 belonging to his terminal (for example also via a headset or a handsfree automobile device connected to the terminal) receives via a mobile radio network known per se and not shown and a terminal downlink data x(t), to be output acoustically which propagates in the vehicle or the room 4 and is also picked up as z(t) by microphone 2 of the terminal (or for the terminal). The microphone 2 of the terminal thus receives strongly or weakly (downlink) data sent by the partner in the call of user 1 and output by the loudspeaker 3 as well as data s(t) output by the user 1 of the terminal (2, 3) as speech etc. and transmits the sum etc of the data (recorded unwanted by loudspeaker 3 and wanted by user 1) as signal y(t) in a known way via a mobile radio terminal, an air interface etc, to the mobile radio network and onwards to the partner in the call of subscriber 1. The partner in the call of the subscriber 1 therefore perceives an echo which is to be suppressed since it reduces the speech quality.

Figure 2 shows how, through an echo canceller, the downlink data x(t) to be transmitted by the partner 5 in the downlink 6 transmitted in a way known per se via a mobile radio network, an air interface etc. to a terminal with a loudspeaker 3 is used for echo reduction.

In accordance with the invention downlink-data x(t) transmitted over the downlink 6 is not only transmitted to the terminal with the loudspeaker 3 for acoustic output there but is copied and a copy is also analyzed independently of the transmission in the direction of the terminal (3) in an echo equalizer 7 and is used for reduction (for example subtraction in specific time segments) of the echo in uplink data y(t) to be transmitted over the uplink 8 after the analysis in an analysis direction 9 in a processor 10.

Figure 3 illustrates what can happen here in an echo canceller 11 in a (or for a)switching device (MSC, Media Gateway etc.) of a telecommunications network (especially a mobile radio network). Data packets 12 to 16 in the downlink 6 are copied from a copying device 17 and transmitted to a transcoding device 18, which undertakes the decoding of the downlink data 13 from a mobile radio codec (etc.) encoding format into a suitable format for the echo canceller (e.g. TDM). While the downlink data copied by the coding device 17 is being transcoded in the decoding device 18 a copy (or the original) of the downlink data can already be forwarded via the downlink 6 in the direction of

the terminal, which avoids a delay in transmission. Data 19 to 22 to be transmitted in the uplink 8 is also converted by a decoding device 23 (from a mobile radio codec format such as AMR etc.) into a format suitable for echo cancellation. The downlink stream data copies analyzed by an analysis device 9 (previously decoded) are analyzed by the analysis device 9 and used in the device 10 in for example a known way for echo cancellation of the uplink data transcoded via the transcoding device 23. The uplink data which now has a reduced echo or ideally no echo any more is then transcoded by a further transcoding device 24 into another format (with mobile radio for example a mobile radio codec format such as AMR or any other format) and forwarded via the uplink 8 to the other party 5 of the terminal user.

What is claimed is:

# Echo suppression with short delay

## CLAIM FOR PRIORITY

This application is a national stage of PCT/EP03/010576, published in the German language on September 23 2003, which claims the benefit of priority to European Application No. 02023552.9, filed on October 22, 2002.

## TECHNICAL FIELD OF THE INVENTION

The invention relates to a method and a device for reducing echoes in uplink data, and in particular to echoes in uplink data, to be transmitted in a telecommunications network, coming from a terminal.

## BACKGROUND OF THE INVENTION

In a very wide variety of telecommunications networks (especially cellular mobile radio networks such as GSM, UMTS, CDMA-IP-based networks etc.) an echo can occur in data sent from a terminal in the direction of the mobile radio network (uplink data), which can arise because acoustic signals output at the terminal by a loudspeaker (which are based on downlink data transmitted from the network to the terminal) are output and picked up in a more or less weak form by the microphone of the terminal. The microphone of the terminal thus receives acoustic signals from the terminal user currently speaking (or using the mobile radio terminal in some other way) and additionally a weak noise in the form of the speech component of the person with whom the terminal user is speaking reproduced

by the loudspeaker of the terminal (arriving as downlink data from the network at the terminal). The voice data of the terminal user recorded by the microphone and the additional (noise) data recorded by the microphone which a microphone in or on the terminal has picked up are transmitted jointly to the other party in the terminal user's call so that in addition to the voice signal of the terminal user, the latter hears his own voice as an echo (that is the voice sequence of the other party in the terminal user's call partner which was transmitted from them to the loudspeaker of the terminal, to the microphone and from the microphone via the terminal back to the other party).

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reduced as far as possible by taking into account the downlink data in the uplink data (echo cancellation). By avoiding this echo the speech quality is significantly improved. However this process delays the transmission to the other party of uplink data originating from the terminal over the telecommunications network and also the transmission to the terminal of data originating from the other party as downlink data over the telecommunications network.

## SUMMARY OF THE INVENTION

The ~~object of the~~ present invention ~~is, for~~ discloses a reduction of the echo in the uplink data coming from a terminal, to optimize as efficiently as possible the delay in data by echo cancellation. ~~The object is achieved by the objects of the Independent claims in each case. In that, i~~In accordance with one embodiment of the invention, the data (downlink-data) to be sent to the terminal is copied and sent as original or as a copy to the terminal, whereas a copy or the original of the downlink data is used transcoded to reduce the echo in uplink data~~,~~. ~~o~~On the one hand, the downlink data arrives without delay at the terminal and, on the other hand, echo cancellers can be used simply and efficiently in a manner known per se without modification to reduce the echo in uplink data.

## BRIEF DESCRIPTION OF THE DRAWINGS

~~Further features and advantages of t~~The invention ~~are produced by the claims and the subsequent description of an~~

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Figure 3 shows reduction of the echo in accordance with the invention while avoiding the delay in the transmission of downlink data.

## DETAILED DESCRIPTION OF THE INVENTION

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mobile radio terminal, an air interface etc, to the mobile radio network and onwards to the partner in the call of subscriber 1. The partner in the call of the subscriber 1 therefore perceives an echo which is to be suppressed since it reduces the speech quality.

Figure 2 shows how, through an echo canceller, the downlink data x(t) to be transmitted by the partner 5 in the downlink 6 transmitted in a way known per se via a mobile radio network, an air interface etc. to a terminal with a loudspeaker 3 is used for echo reduction.

In accordance with the invention downlink-data x(t) transmitted over the downlink 6 is not only transmitted to the terminal with the loudspeaker 3 for acoustic output there but is copied and a copy is also analyzed independently of the transmission in the direction of the terminal (3) in an echo equalizer 7 and is used for reduction (for example subtraction in specific time segments) of the echo in uplink data y(t) to be transmitted over the uplink 8 after the analysis in an analysis direction 9 in a processor 10.

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codec (etc.) encoding format into a suitable format for the echo canceller (e.g. TDM). While the downlink data copied by the coding device 17 is being transcoded in the decoding device 18 a copy (or the original) of the downlink data can already be forwarded via the downlink 6 in the direction of the terminal, which avoids a delay in transmission. Data 19 to 22 to be transmitted in the uplink 8 is also converted by a decoding device 23 (from a mobile radio codec format such as AMR etc.) into a format suitable for echo cancellation. The downlink stream data copies analyzed by an analysis device 9 (previously decoded) are analyzed by the analysis device 9 and used in the device 10 in for example a known way for echo cancellation of the uplink data transcoded via the transcoding device 23. The uplink data which now has a reduced echo or ideally no echo any more is then transcoded by a further transcoding device 24 into another format (with mobile radio for example a mobile radio codec format such as AMR or any other format) and forwarded via the uplink 8 to the other party 5 of the terminal user.

~~Patent claims~~ What is claimed is: